CHAPTER

8

Augmentation and Recharge Program

8.1 INTRODUCTION

The purpose of the Augmentation and Recharge Program is to encourage the development, delivery, use, and storage of renewable water supplies now and in the future. The Augmentation and Recharge Program, in combination with conservation program efforts, is intended to support achievement of the safe-yield management goal for the Prescott Active Management Area (AMA). Increasing the use of renewable supplies to replace groundwater mining is a key component of achieving safe-yield.

For purposes of this chapter, "augmentation" means increasing the availability and use of renewable water supplies such as effluent in lieu of groundwater. "Recharge" means storage of water supplies for future use pursuant to the Underground Water Storage, Savings and Replenishment Act.

Although the Prescott AMA groundwater management goal of safe-yield considers the AMA as a whole, the objectives of the Augmentation and Recharge Program in the third management period reflect an increased awareness and improved understanding of the importance of water management on a smaller scale. An AMA-wide "paper balance" between supply and demand for groundwater does not address local concerns regarding groundwater level declines, physical availability problems, and poor groundwater quality, because it allows for substantially variable water level conditions in the AMA. The Third Management Plan incorporates a new focus on water management by taking these site-specific or "critical areas" into consideration, and looks for solutions to the problems where possible.

Conservation activities will play an important role in achieving safe-yield by ensuring the efficient use of the finite groundwater resources of the AMA. However, the augmentation and recharge of renewable water resources will be the principal mechanism by which the AMA can meet its safe-yield and sub-regional goals. Through its Third Management Plan Augmentation and Recharge Program, the Arizona Department of Water Resources (Department) will use the authorities available to facilitate and encourage the development, efficient use, and recharge of renewable water supplies for the AMA, especially in critical areas.

The state's Recharge Program, authorized under the Underground Water Storage, Savings and Replenishment Act (Arizona Revised Statutes, Title 45, Chapter 3.1), is an important tool in the Third Management Plan Augmentation Program. While the development and direct use of renewable water supplies is an important component of the Augmentation Program during the third management period, the Recharge Program provides a cost-effective means of storing water that is currently available to the AMA but that has no direct use. Additionally, the Recharge Program can be an effective tool in helping to mitigate problems associated with critical areas, depending where storage and recovery occur.

At the time the Assured Water Supply Rules (AWS Rules) were being developed, there was considerable debate as to whether or not the Prescott AMA was at safe-yield. The adopted rules specified that the director shall determine that the AMA is not at safe-yield when a minimum of three consecutive years of data demonstrate groundwater mining conditions. Subsequent hydrologic data derived through the Department's groundwater modeling efforts and expanded monitoring program, however, have revealed ongoing groundwater overdraft within the Prescott AMA. Based on the data and other water records maintained by the Department, the Prescott AMA annually generates greater water demand than what is replenished into the aquifer.

In January, 1999, the director issued a final decision and order declaring that the Prescott AMA is mining groundwater and is no longer in safe-yield. This decision was based on years of hydrologic data reflecting overdraft conditions, a preliminary determination of groundwater mining in the Prescott AMA, and public review and comment on the determination as well as an independent evaluation. Because Prescott is not in safe-yield, future development in the area will be required to demonstrate consistency with the AMA management goal as a condition for receiving a Designation of Assured Water Supply (Designation of

AWS) or Certificate of Assured Water Supply (Certificate of AWS). The "consistency with the management goal" provision in the Assured Water Supply Program (AWS Program) requires that applicants demonstrate reliance on renewable supplies rather than groundwater.

Ultimately, the challenge for water planners in the Prescott AMA will be to put available alternative water supplies to beneficial use. Although some water users within the AMA are currently able to put alternative or imported water supplies to beneficial use, others lack either access or sufficient infrastructure to effectively use alternative supplies that are available from within the Prescott AMA or imported groundwater from the adjacent Big Chino Subbasin. In order to implement an augmentation and recharge program for the Prescott AMA, the various water users need to work together to retrieve and distribute alternative water supplies.

While the principal responsibility for developing water supplies remains with the region's water users, the Department has an important role in facilitating the development and maximum use of these supplies. The current scope of the Department's activities in augmentation and recharge includes the following:

- Statutory roles. The director of the Department is statutorily designated as the representative of the State of Arizona in Colorado River and interstate water issues; advisor to the Secretary of the Interior (Secretary) in allocating water among users; coordinator of Arizona's review and comments on water development proposals by the United States Army Corps of Engineers, Secretary of the Interior, and Secretary of Agriculture; chairperson of the Arizona Water Banking Authority; and manager of the state's water rights to ensure achievement of water management objectives.

- Regulatory and permitting authority. The Department's regulatory and permitting authority regarding use of water rights and development of underground storage and recovery projects ensures that these uses of water are consistent with water management objectives.

- Regulatory incentives. Regulatory incentives established in the agricultural, municipal, and industrial conservation programs (chapters 4, 5, and 6, respectively) and the Department's AWS Rules facilitate the implementation of augmentation activities by water users.

- Staff support to the Arizona Water Protection Fund. The Department's staff assists the Arizona Water Protection Fund (AWPF) Commission in carrying out their mandates. Both entities are operated in close coordination with Departmental activities.

- Technical and planning assistance. The Department provides technical assistance by reviewing and providing input on proposals for water augmentation and recharge projects, planning and feasibility studies, project operations, data interpretation and development of hydrologic models.

- Data management and public information. The Department's responsibility for accumulation and dissemination of water use and water supply data provides the information necessary to develop water management plans, implement augmentation projects, conduct research related to increasing available water supplies, and identify areas requiring additional water management.

- Coordination and facilitation of efforts. The coordination and facilitation of augmentation and recharge activities, particularly between jurisdictions and multiple regulatory agencies, are an important component of the Department's statewide and regional water planning responsibilities.

- Financial assistance. The augmentation and conservation assistance fund, as well as specifically budgeted appropriations, provide financial assistance to entities implementing augmentation

projects or studies that contribute to achieving the AMA management goal or resolving regional water management issues.

The remainder of this chapter will more fully describe these considerations and will explain the Augmentation Program for the Prescott AMA for the third management period in the order listed below:

- An assessment of the groundwater supplies in the AMA
- An assessment of the renewable water supplies that are available to augment the AMA's water supplies
- An assessment of the Augmentation Program in the Second Management Plan
- An assessment of water management issues facing the Prescott AMA
- The Third Management Plan augmentation program goals and objectives
- The Third Management Plan Augmentation and Recharge Program
- Future directions

8.2 PHYSICAL ASSESSMENT OF THE ACTIVE MANAGEMENT AREA

Attaining the safe-yield goal will not necessarily eliminate water supply problems facing the Prescott AMA water users. Different localities within the AMA have very diverse water supply problems, including groundwater declines and other physical availability problems. Varied physical conditions and resulting impacts to AMA residents demonstrate a need to develop a sub-regional management strategy during the third management period.

8.2.1 Groundwater Overdraft

Based upon the 1995 Department modeling report for the Prescott AMA, the 1990-1997 water planning budget depicted in Chapter 3 (Table 3-11) reveals a generally consistent pattern of annual groundwater overdraft within the Prescott AMA. Despite annual fluctuations in the overall balance of water demands versus what is recharged back into the aquifer, the cumulative volume of groundwater overdraft increased by more than 30,000 acre-feet between 1990 and 1997. With the exception of a surplus year in 1993, which produced an estimated 11,160 acre-foot surplus of water, annual groundwater overdraft estimates ranged from a low of about 4,905 acre-feet in 1995 to a high of 14,188 acre-feet in 1996.

Although the time period represented in Table 3-11 is a brief period from a hydrologic perspective, it does represent a climatic period of wetter climatic conditions than the long-term average. A substantial decline in agricultural activity has also occurred since 1980, while municipal growth has not yet approached the scale of historic agricultural water use experienced in the 1970s and early 1980s. Consequently, the current status of groundwater overdraft may actually represent a transition period of lower overall water demand, where municipal growth has yet to achieve levels of water use comparable to those of agriculture during its heyday. Based on the water use pattern displayed in recent years, it is clear that municipal demand is increasing and that it will eventually surpass peak historic levels of agricultural water use.

While alternative waters (surface water and effluent) have been increasingly used by regulated agricultural and municipal water users, groundwater is still principally relied upon to meet these demands. A significant amount of unregulated groundwater use also results from the sizeable number of exempt wells (Figure 3-11) within the Prescott AMA used for domestic purposes. The Prescott AMA is unique in that water use associated with exempt wells exceeds 13 percent of municipal water use within the AMA, whereas in other AMA's this figure is generally significantly less.

Municipal water users have alternative water sources or other additional water supplies available to them, but they face the challenge of retrieving these supplies and putting them to practical and beneficial use in a cost-affordable manner.

8.2.1.1 Consequences of Groundwater Overdraft

Sustained groundwater mining in the Prescott AMA could have negative consequences in addition to the loss of the resource. Lower water levels could reduce well productivity, increase pumping costs, destroy riparian habitat, and reduce stream flows. As water levels are lowered, water in storage is reduced and water supplies become jeopardized. Although land subsidence has not previously occurred in the Prescott AMA, lowered water levels could potentially cause future land subsidence to develop.

8.2.1.1.1 Little Chino Subbasin

Within the Little Chino Subbasin, groundwater for the City of Prescott and the large agricultural water users in the Chino Valley area is obtained from a few high capacity wells which tap the Lower Volcanic Unit (LVU) aquifer. Yields from these wells typically range from 1,000 to 3,000 gallons per minute (gpm). Smaller private water providers and agricultural rightholders, along with exempt well owners, rely exclusively on the Upper Alluvial Unit (UAU) aquifer, which overlays the LVU, for their groundwater supply. A majority of the wells tapping the UAU aquifer are for individual domestic use and have yields of less than 35 gpm. Other agricultural and municipal wells using the UAU aquifer range up to a few hundred gpm. Although UAU wells vastly outnumber the LVU wells within the Little Chino Subbasin, their net volume of water consumed is less than the large capacity municipal and agricultural wells which pump for the LVU aquifer.

A potential problem may arise from the geographical concentration of UAU wells within the Little Chino Subbasin. Presently, several hundred wells are concentrated in the general vicinity of Chino Valley and although individual pump capacities of these UAU wells are small, their combined impact coupled with continued residential growth may produce further declines in water levels in the UAU.

Exempt wells located in hardrock formations are also susceptible to diminishing groundwater supplies. Such wells are located in areas where well yields are minimal, relying on bedrock cracks and fissures that store groundwater from runoff and subsequent infiltration. Well spacing requirements may not be entirely useful in such areas, because the water-bearing nature is essentially "hit or miss" regardless of a well's proximity to other wells. However, since exempt wells in hardrock areas are more susceptible to short-term drought, they are not a particularly secure source of supply, even where pump capacities are generally less than 35 gpm.

8.2.1.1.2 Upper Agua Fria Subbasin

Water use in the Upper Agua Fria Subbasin is comprised primarily of municipal groundwater withdrawals, along with agricultural and exempt well (≤35 gpm) pumping to a lesser extent. Pump capacities of the large wells operated by the Prescott Valley Water District, serving Prescott Valley, generally range from 1,000 to 1,750 gpm, although one well is registered at 3,000 gpm. Other wells in the Upper Agua Fria Subbasin, for the most part, are exempt wells with less than 35 gpm, or are associated with smaller agricultural rights that vary in range up to pump capacities of only a few hundred gpm. Groundwater withdrawals in the subbasin are more a factor of pump size than the UAU aquifer's ability to produce water.

Of greatest concern in the Upper Agua Fria Subbasin is the cone of depression that has developed in Prescott Valley as a result of municipal growth in the vicinity and the corresponding lack of alternative water supplies which are physically available to replace groundwater. Further groundwater declines at Prescott Valley Water District's well field serving Prescott Valley could constrain the availability of future water supplies in times of prolonged drought, particularly if the local population continues to expand at its current rate. Consequently, water augmentation in this area needs to be a priority to ensure the stability of growth in Prescott Valley.

8.2.1.2 Costs of the Mining Declaration

Local groundwater is typically the least expensive water supply. Alternative water supplies may have higher costs, both for the legal right to the water and for the infrastructure needed to treat and deliver the water. Though there may be sufficient mined groundwater available to serve new large developments for a number of years, this ongoing mining of groundwater could not be sustained over the long-term and would ultimately result in higher costs for all groundwater users. These costs include those associated with land subsidence, additional energy to pump water from greater depths, the deepening of wells, and the potential loss of supply from exempt wells.

The declaration of groundwater mining, however, will not stop growth and development in the Prescott AMA. Instead, the declaration changed the rules on what type of water supplies must be used to serve new developments. Alternative water supplies are available that will reduce groundwater mining and help ensure that both current and new residents have sufficient water. These supplies include surface water, effluent, groundwater credits from permanent elimination of grandfathered rights and water imported from outside the Prescott AMA. Regional cooperation between the City of Prescott (City), Prescott Valley, Chino Valley, and Yavapai County would help make these new supplies available at a lower cost.

8.2.1.3 Water Quality Issues

Protecting and managing groundwater quality and matching supplies of different quality to user needs maximizes the beneficial use of water available to the Prescott AMA. The groundwater supplies in the Prescott AMA presently meet all United States Environmental Protection Agency (EPA) and state drinking water standards. However, there are some minor water quality concerns that could present problems for regional water management efforts.

Leaking underground storage tanks (USTs) in Prescott could create volatile organic compound (VOC) plumes in the local aquifer. However, the current source of the City's municipal water supply is situated near Chino Valley, which is located a considerable distance away. If a VOC plume were to migrate in a direction that would jeopardize potable groundwater supplies, stream flows along Granite Creek, or effluent recharge sites, water quality concerns could develop.

Concentrations of septic tanks could cause nitrate contamination in areas with a proliferation of exempt wells, such as Chino Valley, by contaminating the UAU aquifer in the Little Chino Subbasin where the depth-to-water is relatively shallow. Nitrate contamination in the UAU aquifer could force exempt, domestic wells to connect with a water provider. However, the impact on the municipal water supply of the City of Prescott (City) and other large wells is negligible since these wells pump groundwater from the LVU aquifer at a much greater depth.

Radon exceedances have been found in granitic bedrock formations in and around Prescott, Prescott Valley, Dewey, and Humboldt. A proposed federal maximum contaminant level (MCL) for radon could result in the formulation of public pressure to force the closure of several exempt wells situated in these hardrock areas, which would again necessitate connections with nearby water providers.

8.3 ALTERNATIVE WATER SUPPLIES ASSESSMENT

Effluent and surface water are renewable sources of water that can replace the use of groundwater in order to achieve the management goal of safe-yield by the year 2025. Renewable resources can be used directly or they can be stored in the ground in exchange for credits to pump them in the future. While it is important to use renewable water sources efficiently, the Department encourages the use of renewable water sources in place of groundwater because it reverses the damaging condition of groundwater overdraft in an aquifer.

In addition to augmentation of the Prescott AMA's water supply effluent and surface water, a limited supply of imported groundwater may be available to the AMA. While imported groundwater is not a renewable water supply, it is a valuable alternative to groundwater pumped from within the Prescott AMA. In addition, weather modification studies have been conducted to determine if supplies can be augmented by techniques like cloud seeding. Currently, weather modification is probably not a viable alternative supply. However, it may be viable in the future.

8.3.1 Effluent

In 1995, approximately 4,100 acre-feet of effluent was generated in the Prescott AMA, compared to about 2,500 acre-feet in 1990. Prescott's Sundog and Airport wastewater treatment plants have been treating wastewater and subsequently recharging the effluent into the UAU aquifer since the 1980s. Increased effluent generation is attributable in part to increased population, but also to the construction of a new wastewater treatment plant in Prescott Valley which began operation in 1994. The new plant replaced the use of septic systems in major portions of the Prescott Valley area. Table 8-1 provides a summary of effluent generation by the two wastewater treatment plants operated by the City and the plant operated by Prescott Valley, while Figure 8-1 displays their locations within the Prescott AMA. There are no other wastewater treatment plants operating within the Prescott AMA, although this could change in the future if new subdivisions are developed. There is also a possibility that such a facility could be constructed in Chino Valley.

TABLE 8-1
WASTEWATER TREATMENT PLANT PRODUCTION (ACRE-FEET)
PRESCOTT ACTIVE MANAGEMENT AREA

Treatment Plant	1990	1991	1992	1993	1994	1995	1996	1997	Uses
Prescott Valley WWTP	0	0	0	0	531	875	1329	1510	discharged into streambed
Prescott WWTP (two facilities)	2475	2840	3209	3660	2894	3188	2829	3344	irrigation and recharge

WWTP = wastewater treatment plant

Although there are many definitions for effluent, the focus of this discussion is on the use of water generated from municipal wastewater treatment plants (WWTPs). Historically, effluent has been recognized as a valuable resource and has been used within the AMA for several years by the City for turf and agricultural irrigation purposes.

Prescott encourages the use of treated effluent to irrigate turf-related facilities. The City has established a policy requiring all turf and landscape irrigation projects developed after January 1, 1996, as well as all pond and lake filling and maintenance, with annual demand greater than 100 acre-feet, to directly use effluent provided by the City's wastewater treatment plants. Wastewater generated by the City is treated at the Sundog Wastewater Treatment Plant. Effluent is delivered from this city-operated facility to the Antelope Hills Golf Course, which is comprised of two 18-hole courses. Effluent use is also utilized by the new Hassayampa Golf Course and Prescott Lakes development, located in the Prescott AMA. Through these efforts, the Prescott AMA turf sector actually has the highest percentage of effluent utilization of any AMA.

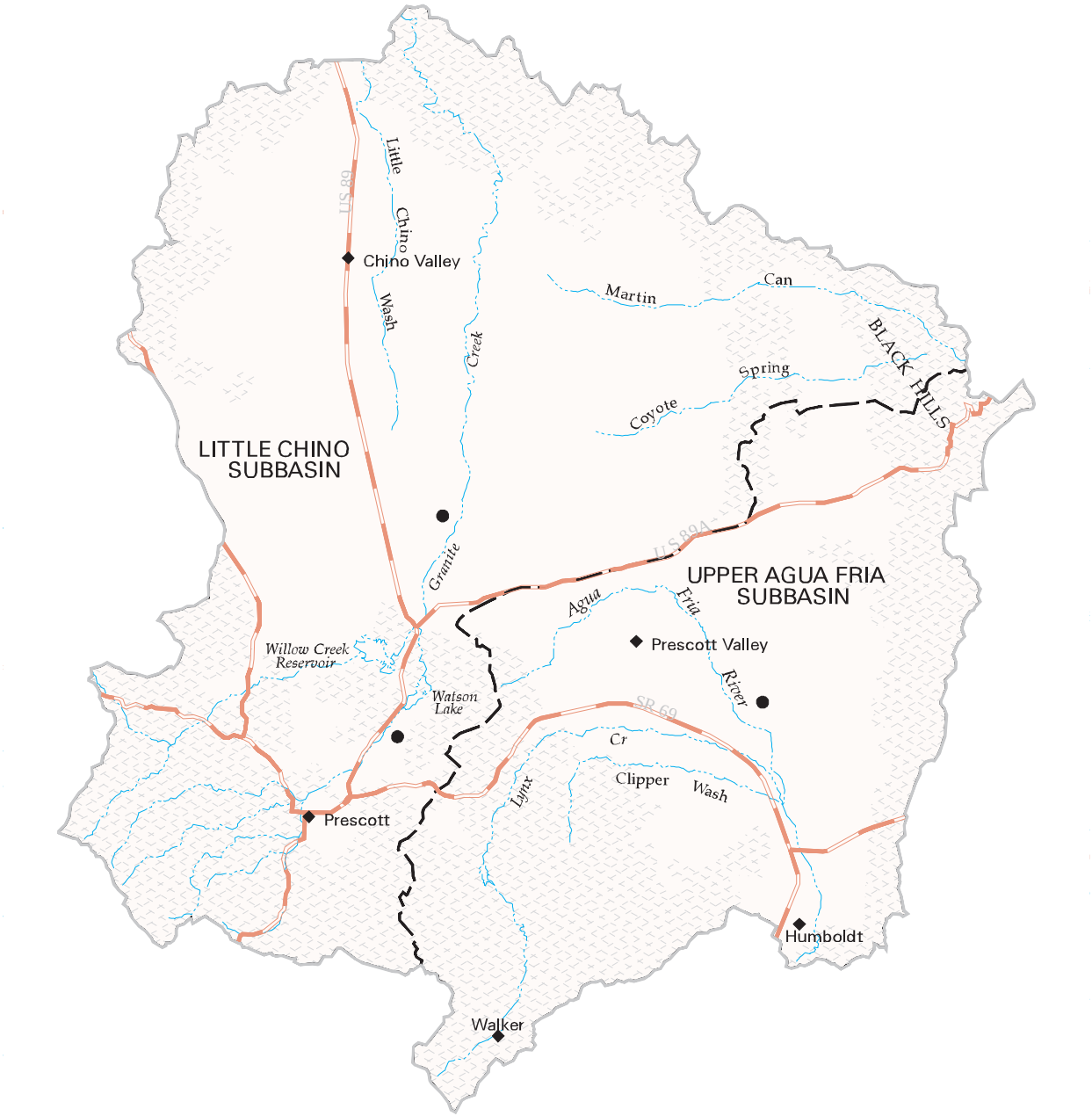


Figure 8- 1

WASTEWATER TREATMENT FACILITIES

Prescott AMA
Hardrock
Subbasins
Waste Water Treatment Facility

SOURCE:
Arizona Department of Water Resources
Geographic Information System

Three factors limit the ability to directly use all effluent generated in the Prescott AMA. First, the quality of the effluent is insufficient to directly introduce it into potable water supply systems. Direct use, therefore, is limited to agricultural irrigation, turf watering, and some industrial applications. Second, effluent demand for irrigation and turf watering purposes is high in summer and low in winter. Effluent generation, however, is directly related to indoor water consumption which is relatively constant throughout the year. Third, over time, effluent generation will exceed the demand for effluent for irrigation and turf watering purposes.

Artificial recharge allows effluent to be stored during low demand periods and later recovered during high demand periods. Recharge also allows the possibility of indirect potable use of effluent. The City currently has an Underground Storage Facility permit for the constructed effluent recharge facility at Prescott Airport, which stipulates that maximum storage at the facility shall not exceed 6,721 acre-feet per annum. The City also has two Water Storage permits pursuant to the facility permit. One Water Storage permit allows the City to store the maximum volume of effluent granted in the facility permit as non-recoverable water. No credits may be issued for the storage of water pursuant to this permit. A second Water Storage permit allows the City to store and receive credits for 6,721 acre-feet per annum. All three storage permits expire on July 8, 2008. Recovery of the stored water is allowed pursuant to a Recovery Well Permit, which the City was issued in January 1998, that allows the City to recover 1,600 acre-feet of recharged effluent annually.

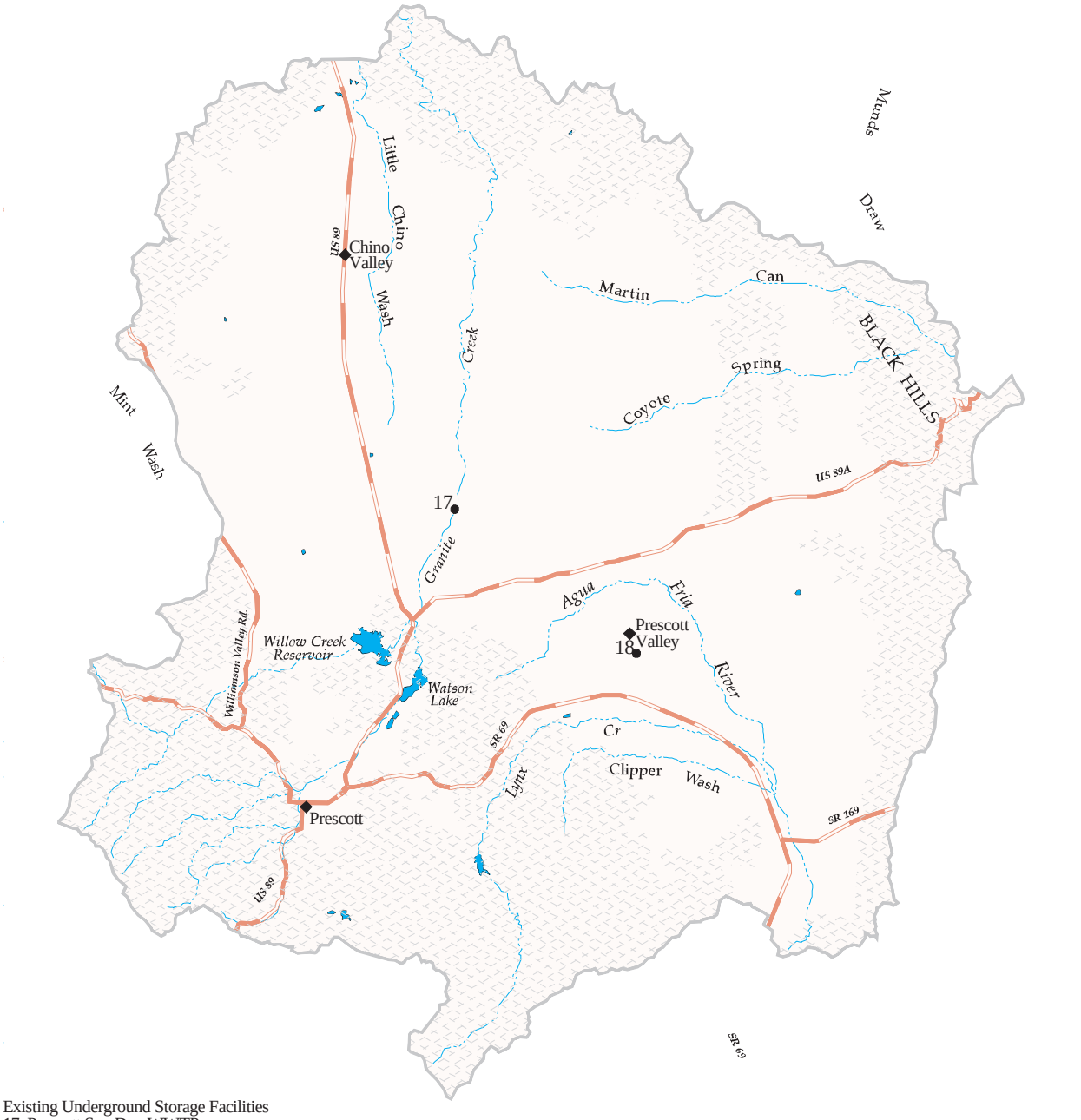
The City has been recharging effluent and receiving credits pursuant to the second Water Storage Permit since 1994. It could recover these credits in the future at recovery wells located at its municipal well field near Chino Valley. An agreement between the City and the CVID could result in the recovery of effluent recharge credits through wells located throughout the CVID as part of water exchange agreements. Furthermore, a wastewater treatment plant may be constructed in Chino Valley, which would enable Chino Valley to recharge effluent and receive effluent recharge credits.

Prescott Valley is also very interested in obtaining permits which would enable it to recharge effluent and accumulate recharge credits. Prescott Valley is currently exploring the potential to deliver effluent for non-potable uses (irrigation) to municipal and industrial water users within its jurisdiction. Effluent recharge credits represent a long-term alternative water source (subject to physical availability limitations) which could help offset Prescott Valley's dependence on groundwater. Presently, its wastewater treatment facility has the capacity to treat 2,800 acre-feet of effluent annually. Treated effluent from this facility is currently discharged into the Agua Fria River, pursuant to a National Pollutant Discharge Elimination System (NPDES) permit. Figure 8-2 displays the locations of existing and proposed recharge sites, in the Prescott AMA.

Physical factors impacting recharge feasibility include: infiltration rates, permeability, available storage, and the existence and extent of lower permeability or impermeable layers in the vadose zone. In some urban areas of the Prescott AMA, there is insufficient space to develop recharge sites or land costs are too high for a project to be economically viable.

8.3.2 Surface Water

Since the Second Management Plan was promulgated, it has become clear that the use of Central Arizona Project (CAP) water is not economically feasible in the Prescott AMA due to the distance of the AMA's water users from the CAP aqueduct. Recognizing this, the City and the Yavapai-Prescott Indian Tribe sold their CAP allocations to develop a funding source for the acquisition of other alternative water supplies.



Existing Underground Storage Facilities
17. Prescott Sun Dog WWTP
18. Town of Prescott Valley

- Existing Underground Storage Facilities
- Prescott AMA
- Hardrock
- Lakes and Reservoirs
- Rivers and Streams
- Major Roads
- Cities

Figure 8- 2

Existing and Proposed Recharge Sites

ORIGINAL SOURCE
Arizona Department of Water Resources
Geographic Information System

0 1 2 3 4
Miles

North

Historically, storm water runoff from Granite Creek and Willow Creek has been impounded at Watson Lake and Willow Lake. When available, these waters had been diverted to CVID member lands for agricultural irrigation. The City has completed negotiations with the CVID to purchase these rights. The City has expressed a desire to maintain the lakes for recreational purposes by retaining the surface water which would normally be diverted to the CVID. The combined capacity of Watson and Willow Lakes is estimated to be roughly 11,000 acre-feet. Maintenance of sufficient water levels for recreational or municipal consumptive use would need to take into account annual losses from evaporation. In the event water levels increase substantially to a point near lake capacity, subsequent spill flows would be discharged downstream into Granite Creek. The City expects to be able to annually store and recover about 1,500 acre-feet of recharged surface spill water once water storage and recovery well permits are issued. Due to statutory provisions, this water must be stored and recovered on or before the last day of the following month or within the same calendar year, whichever is earlier.

While the potential for direct municipal use of this alternative water supply is currently remote, future growth may result in further exploration of potable use of this water to meet growing municipal demands. The City would probably not directly use this source unless a cost-efficient mechanism for treating and delivering surface water from the lakes to its service area customers could be developed.

Future water exchanges involving surface water may be possible. Details of how this could occur have not yet been explored, but would likely involve some type of water exchange including surface water along the Verde watershed, possibly from the Granite Creek drainage system, and stored water from Watson and Willow Lakes. Additionally, through severance and transfer of water rights to Lynx Lake, approximately 500 acre-feet of surface water could potentially be used annually as municipal water supply for Prescott Valley and/or recreation.

The City possesses surface water rights along Del Rio Springs. Although baseflows at Del Rio Springs currently exit the Prescott AMA, the City could execute its water rights and begin using the flows at this site. The City will install a shallow well and start pumping subsurface water at this site, subsequently transferring it to an underground storage facility near its municipal well field for municipal use. A more straightforward way to access this supply would be through a surface water impoundment. Once surface flows are captured, they could be recharged or diverted for delivery and use within the City service area.

8.3.3 Imported Groundwater from the Big Chino Subbasin

Groundwater importation from the Big Chino Subbasin, which is located completely outside the AMA, is allowable per statute. A.R.S. § 45-555. The Groundwater Transportation Act reserved groundwater supplies in the Big Chino Subbasin for use in the Prescott AMA and authorized the transfer of those supplies across subbasin boundaries. The Groundwater Transportation Act allows municipalities in the Prescott AMA to withdraw groundwater in the Big Chino Subbasin to meet municipal and industrial demand. Private water companies are restricted from using this provision and cannot, therefore, directly acquire imported groundwater.

The City has subsequently purchased land in the Big Chino Subbasin on which it could potentially construct a well field. A pipeline could be constructed between this well field and the existing City storage facilities located near the Town of Chino Valley. The Transportation Act allows the City to annually import 14,000 acre-feet of groundwater. It is possible for the City to become a wholesale water supplier for other users in the AMA if it begins importing groundwater. Another potential scenario under which Big Chino groundwater would be used envisions the Prescott AMA water providers forming some type of district, similar to a groundwater replenishment district, where they would import groundwater and subsequently store it in an underground location.

Prescott Valley, as well as any city or town in the Prescott AMA, could also acquire Big Chino groundwater by purchasing or leasing historically irrigated lands in the Big Chino Subbasin directly, pumping up to 3 acre-feet per acre and building a pipeline from the well field to the service area. Another option could be to enter into a contractual agreement with the City or to join an augmentation and replenishment district for the purposes of acquiring Big Chino groundwater through the City. Such an effort would require a more detailed study into the impacts of pumping on the Verde River and downstream water users, however.

8.3.4 Water Created by Weather Modification

Weather modification studies to enhance water supplies have been conducted for a wide variety of water users including water resources managers, hydro-electric power companies, and agriculture. In 1989, Arizona was one of six states funded through the National Oceanic and Atmospheric Administration's atmospheric modification program to answer the question of whether cloud seeding could be used to increase winter precipitation on the Mogollon Rim. Through this program, the Department was awarded $0.5 million per year as the principal investigator. The University of Arizona was the primary scientific investigator to determine the feasibility and desirability of an operational cloud seeding program for increasing water supplies in central and northern Arizona.

A report was issued in February, 1997 by the University of Arizona on behalf of the Department which summarized the results of this study. Although the study was successful in yielding a large volume of data about the factors influencing storm and precipitation formations in the Verde Valley region, the impacts of cloud seeding are not considered to have any significant impact on precipitation levels in the Prescott AMA. Therefore, water created by weather modification does not currently represent an alternative water supply for the Prescott AMA.

8.4 ASSESSMENT OF THE SECOND MANAGEMENT PLAN AUGMENTATION PROGRAM

The Code did not require the Department to include a water supply augmentation program in the Prescott AMA's First Management Plan. However, the Code did require the Department to include such a program, including incentives for artificial groundwater recharge, in the Second Management Plan for each AMA. A.R.S. § 45-565(A)(6). The Code defines augmentation as supplementing the water supply of an AMA, including the importation of water into the AMA, water storage, and artificial groundwater recharge. A.R.S. § 45-561.2.

The Augmentation and Reuse Program in the Second Management Plan was designed to increase the use of alternative water supplies in the Prescott AMA during the second management period (1990-2000) in order to reduce the overall dependence on groundwater withdrawals for meeting water demands. The program encouraged the use of CAP water and effluent in order to preserve groundwater for future uses in the AMA. To maximize use of these water supplies, the program included provisions to incorporate groundwater recharge into plans for water supply development.

The Second Management Plan stated that during the second management period the Department would take a lead role in identifying, facilitating, and coordinating augmentation activities. The Department would also provide planning support, technical support, and financial assistance to entities wishing to implement augmentation projects in the Prescott AMA during the second management period.

8.4.1 Second Management Program Goals and Objectives

The Second Management Plan Augmentation and Reuse Program goal was to develop additional water supplies and to increase the use of renewable water supplies in the Prescott AMA for the purpose of

attaining safe-yield. The program encouraged full utilization of CAP water and effluent to preserve groundwater for future uses in the AMA. To maximize the use of these water supplies, the program included provisions to incorporate recharge into plans for water supply development.

Five objectives were identified for the Second Management Plan Augmentation and Reuse Program. The objectives were: (1) maximize the use of CAP allocations within the AMA; (2) maximize recharge and underground storage and recovery of effluent that cannot be used directly; (3) generate additional water supplies within the state to maximize the benefit to the AMA of inter-regional water transfers and exchanges; (4) resolve technical, institutional, legal, and environmental constraints that inhibit the development and beneficial use of alternative water supplies; and (5) research and identify augmentation measures for future implementation.

8.4.2 Second Management Plan Program Implementation

The Second Management Plan recognized that while the Department may provide incentives and coordination efforts, the principal responsibility for developing water supplies remains with the region's water users. Each element of the Second Management Plan Augmentation and Reuse Program is discussed below.

8.4.2.1 Second Management Plan Regulatory Incentives

Provisions established in the conservation programs of the Second Management Plan provided incentives for water users in the Prescott AMA to augment their supplies, especially by encouraging the direct use of effluent. The overall effectiveness of these regulatory incentives, discussed in previous chapters of this management plan, has been limited at best. The principal reason for this lack of effectiveness is that the incentives have little or no effect on water cost or availability, which are the main factors in determining whether renewable supplies will be used instead of groundwater. Availability is especially critical in the case of effluent use because only water users in close proximity to treatment plants are able to receive effluent due to the limited distribution systems of the plants.

8.4.2.2 Technical Assistance Through the Second Management Plan

The Second Management Plan stated that the Department would support augmentation project construction, planning, and research activities during the second management period. The AMA provided technical assistance to water users by assessing the need for developing augmentation projects and determining their feasibility. Department staff also assisted with study, design, data collection, data analysis, and information dissemination.

Because of its small staff size, the Prescott AMA's ability to provide technical assistance to water users is limited. The AMA, however, put a high priority on such support to ensure that augmentation planning and research activities resulted in high quality products that addressed the AMA's augmentation objectives.

8.4.2.3 Coordination and Facilitation of Efforts During the Second Management Plan

Because cooperative efforts among government agencies, water users, and other groups allow the development of larger, more effective augmentation projects and studies, the Second Management Plan stated that the Department would work with organizations to coordinate and facilitate augmentation activities.

Since passage of the Underground Storage and Recovery Act in 1986, the Department and the AMA have worked closely with water users to permit recharge projects. This level of facilitation is critical, especially for storage facility permits, because applicants are required to submit substantial, often detailed

information that must be reviewed by the Department for completeness and correctness. In the Prescott AMA, the Department has permitted one constructed underground storage facility at Prescott Airport. The Department has also issued two water storage permits for this facility.

In addition, in the early to mid 1990s, the Department coordinated a multi-agency research effort, known as the Arizona Atmospheric Modification Program, to assess the feasibility of using weather modification in the Verde River watershed to increase water supplies. The study confirmed that it is possible to accurately predict both the amount and distribution of precipitation resulting from cloud seeding.

8.4.2.4 Resolution of Institutional and Legal Barriers During the Second Management Plan

The Second Management Plan stated that the Department would work with interested parties in the AMAs and around the state to draft rules and to propose legislation that would resolve these and other regulatory and institutional problems in developing large-scale augmentation projects. This element of the Second Management Plan Augmentation Program may have been one of the most successful during the second management period. The following describes rules, legislation, and programs that have resulted from the efforts of the Department, water users, and other interested parties.

8.4.2.4.1 Assured and Adequate Water Supply Rules

In February 1995, the Department adopted new rules for its Assured and Adequate Water Supply Program, which requires new subdivisions to use renewable supplies and provides a critical incentive for underground storage of unused supplies to be conducted for future use. The AWS Program applies to new subdivided developments (currently defined as six or more parcels with at least one parcel having an area less than 36 acres) within AMAs, and the adequate water supply program applies to new unsubdivided developments within AMAs and all new developments outside of AMAs. The AWS Rules are intended to aid in achieving the AMA water management goal and to ensure sufficient water supplies for new development by requiring that new development be largely based on an alternative water supply that is sufficient to meet the demand of the development for 100 years.

8.4.2.4.2 Groundwater Transportation Act

Passage of the 1991 Groundwater Transportation Act severely restricted the ability of municipal water providers to transfer groundwater from rural basins to AMAs. In general, the Groundwater Transportation Act of 1991 restricts the transport of groundwater from rural groundwater basins to initial AMAs, which include the Prescott AMA. A.R.S. §§ 45-551, *et seq.* The Groundwater Transportation Act, however, contains several exceptions that allow transportation of limited amounts of groundwater to the Prescott AMA from groundwater basins outside the AMA. Thus, under the Groundwater Transportation Act, and under very limited circumstances, groundwater could be imported into the AMA from a number of locations. Although the Groundwater Transportation Act in general prohibits groundwater transfers, it does specifically identify which water supplies are available to augment the Prescott AMA supplies. Provisions pertaining to groundwater from the Big Chino Subbasin were described previously in section 8.3.3.

8.4.2.4.3 Water Exchange Act

Passage of the 1992 Water Exchange Act establishes a legal mechanism to allow water-for-water trades between two or more parties. A.R.S. §§ 45-1001, *et seq.* Exchanges allow for improved management of limited water supplies. Water exchanges can reduce the cost of water deliveries and allow the quality of water to be matched with the requirements of the user.

8.4.2.4.4 Underground Water Storage, Savings and Replenishment Program

In the late 1980s and early 1990s, the Legislature enacted a series of underground water storage programs. The first of these programs established a legal mechanism to physically store water underground and to later recover that water. Later enactments allow for unused renewable water supplies to be provided to groundwater users in lieu of groundwater. In 1994, the Underground Water Storage, Savings and Replenishment Act repealed these previous enactments and consolidated all of the storage programs into a unified program. A.R.S. §§ 45-801.01, *et seq.* The result has been a more unified permitting system, a unified accounting system for all water stored, and readily assignable storage rights accrued under the program.

8.4.2.4.5 Arizona Water Protection Fund

In 1994, the AWPF was created to issue grants to water users for implementing projects to protect the state's rivers and streams. AWPF grants could impact future augmentation activities in the Prescott AMA. One project recently funded is being used to assess the hydrologic connections between the Big Chino, Williamson, and Little Chino aquifers, and the headwaters of the Verde River. Data collected will be used to determine what effect groundwater pumping may have on the flow of the upper Verde River. Another funded project will allow an inventory of vegetation within the Watson Woods Riparian Preserve to be conducted to determine baseline conditions and guide management plans for restoration of this floodplain ecosystem.

8.4.2.5 The Second Management Plan Augmentation and Conservation Assistance Fund

The Prescott AMA Augmentation and Conservation Assistance Program facilitates development of technologies and dissemination of information to assist water users to attain the goal of safe-yield by 2025. Through 1996, the Code allowed an augmentation and conservation assistance fee of up to $2.00 per acre-foot per year to be levied on groundwater withdrawals. The Prescott AMA's augmentation and conservation assistance fee has been $1.00 per acre-foot since 1990. Monies collected from the fee have ranged from over $15,000 in 1990 to more than $17,000 in 1996. These monies provide the basis for the Augmentation and Conservation Assistance Fund. In the Second Management Plan, monies in the fund were designated for augmentation to provide: (1) cost-sharing grants for augmentation projects and studies initiated or conducted by private or public entities, and (2) funds for augmentation projects and studies initiated or conducted by the Department.

8.4.3 Summary of Program Effectiveness

Overall, the implementation of the Second Management Plan Augmentation and Reuse Program for the Prescott AMA has been effective. The Department has taken a lead role in facilitating and coordinating augmentation activities and in resolving many of the institutional and legal barriers to such activities. The Prescott AMA has provided significant technical and financial assistance to entities wishing to implement augmentation projects during the second management period.

The primary objectives identified for the Second Management Plan Augmentation and Reuse Program have generally been met. The Augmentation and Reuse Program has enabled the City of Prescott to use effluent at turf facilities and to accumulate a growing volume of effluent credits which may be recovered for future use or used to offset gallons per capita per day (GPCD) coverage. Other water users in the Prescott AMA, which have yet to apply effluent to beneficial use and be eligible for these incentives, may do so in the future. Although the effluent from Prescott Valley's wastewater treatment plant is currently discharged into the Agua Fria River, the program is in place so that Prescott Valley's effluent can be applied to turf facilities or recharged and stored for credits with the approval of a Water Storage Facility Permit and a Water Storage Permit. A challenge for the Augmentation and Reuse Program is to provide

assistance to municipal water users and exempt well owners who do not have access currently to alternative water supplies.

8.5 PRESCOTT ACTIVE MANAGEMENT AREA AUGMENTATION ISSUES

The physical assessment of this chapter identifies several water management problems existing in the AMA. Even with positive strides made in renewable resource use and other water management efforts through the Second Management Plan, several augmentation issues still remain to be addressed through the third management period and beyond.

First, although use of renewable supplies is expected to increase in the future, groundwater pumping will continue to contribute toward overdraft. Existing grandfathered rights (irrigation grandfathered rights, Type 1 and Type 2 non-irrigation rights) and withdrawal permits exceed total incidental recharge and natural recharge. No legal requirement exists for these uses to diminish over time. In addition, Type 2 non-irrigation rights can be relocated anywhere in the AMA, including areas experiencing serious water table declines or areas where the groundwater supplies have been fully committed under the AWS Program. Furthermore, in most areas of the AMA, the cost of producing groundwater is lower than alternative water supplies; thus, it will remain the economic choice for many water users in the AMA.

Second, where renewable water supplies are available, the Department should encourage augmentation and recharge of such water. The Department's review of the renewable water supplies available to the Prescott AMA establishes that some excess renewable water supplies are available to the AMA for an augmentation program. In particular, effluent is not fully utilized and is available for direct use and recharge.

Third, a critical management area strategy should be developed during the third management period. In some areas of the AMA, local groundwater supplies are fully committed for assured water supply purposes (thereby preventing growth in the area without additional renewable supplies). Not only will the Third Management Plan encourage storage facilities in these areas in coordination with local partnerships, but it will continue to provide storage and recovery criteria which help to maximize the benefits and reduce the negative impacts to the AMA.

In summary, an augmentation program established to assist the Prescott AMA in reaching its goal of safe-yield must be designed to consider local water issues. Recharge should be encouraged at the highest efficiency possible, facilitated in areas where water tables are low, and located where groundwater supplies are already fully committed. Additional protection of local water supplies, in conjunction with a local area commitment to help, may be needed in areas experiencing local supply problems.

8.6 THIRD MANAGEMENT PLAN AUGMENTATION PROGRAM GOAL AND OBJECTIVES

This Augmentation and Recharge Program chapter has thus far highlighted the physical groundwater supply problems experienced in various locations throughout the Prescott AMA, the availability of renewable water supplies, the successes and shortcomings of the Augmentation Program for the second management period in the AMA, and the water management challenges facing the AMA as the third management period approaches. The Department has developed the goals and objectives of the Augmentation and Recharge Program for the third management period based upon these AMA considerations. The Augmentation and Recharge Program for the third management period is intended to move the Prescott AMA toward its goal of safe-yield and to begin to address sensitive areas by emphasizing the following objectives:

- Facilitate the creation of an AMA augmentation and groundwater replenishment district to provide alternative water supplies to municipal water users which currently lack access.

- Maximize the recharge of alternative water supplies, including effluent, that cannot be used directly.
- Develop a regional recharge plan to coordinate storage and recovery of alternative water supplies in a manner consistent with the AMA's management goal and objectives.
- Expand the existing groundwater and surface water monitoring program for the Prescott AMA to facilitate effective implementation of regional water management strategies and the AMA's conservation and augmentation programs.
- Assess the need for developing and implementing a program to reduce groundwater withdrawals through the purchase and retirement of grandfathered rights.
- Maximize the benefit to the AMA of interregional water exchanges.
- Continue to research and identify augmentation measures for future implementation, including the study of legal, institutional, technical, environmental, and economic constraints that inhibit the development and use of alternative water supplies.
- Assess the potential to develop alternative water supplies from outside the Prescott AMA.

The possibilities and need for augmentation during the third management period differ substantially among the five AMAs. During the third management period, the Prescott AMA will assist water users to develop additional water supplies and maximize the use of existing alternative water supplies in meeting the AMA management goal. To accomplish this, the Department will first seek to identify all potential measures available to the Prescott AMA. Proposed measures will be evaluated based on their cost and physical practicality in implementation. The amount of information available for water management has already increased through the development of groundwater and surface water monitoring programs by the Department to facilitate effective implementation of water augmentation and recharge plans. Furthermore, the Department will work to develop avenues from which local water interests can work together to promote improved water resource management and secure the long-term availability of water supplies to support existing and new growth.

8.7 THE THIRD MANAGEMENT PLAN AUGMENTATION AND RECHARGE PROGRAM

The Department is required to include in the Third Management Plan "a program for additional augmentation of the water supply of the active management area, if feasible, including incentives for artificial groundwater recharge." A.R.S. § 45-566(A)(6). "Augmentation" in this context is statutorily defined to mean "to supplement the water supply of an active management area and may include the importation of water into the active management area, storage of water or storage of water pursuant to chapter 3.1 of this title." A.R.S. § 45-561(2). As described in the introduction, the Department must remain consistent with this statute, but for purposes of this chapter a finer distinction has been drawn: *augmentation* means increasing the availability and use of renewable supplies such as effluent in lieu of groundwater and *recharge* means storage of water pursuant to Title 45, Chapter 3.1, the Underground Water Storage, Savings and Replenishment Act. The Augmentation Program therefore includes provisions for maximizing the use of renewable supplies and for storage of renewable water. Additionally, the Third Management Plan may include a plan for the purchase and retirement of grandfathered rights beginning no earlier than January 1, 2006. A.R.S. § 45-566(A).

The principal responsibility for developing water supplies and for storing that water for future uses lies with the area's water users. The Department's responsibility under A.R.S. § 45-566(A) is to design an augmentation program that encourages and facilitates the efforts of those water users. The program should particularly encourage augmentation and storage of water where groundwater supplies are limited. The

Augmentation Program, however, must also allow the Department to use the authorities granted by the Legislature to prevent unreasonable harm to third parties and to avoid aggravating existing local water supply problems.

The Third Management Plan Recharge Program derives from A.R.S. § 45-801.01, *et seq.*, the Underground Water Storage, Savings and Replenishment Act, which details the statutory requirements for storing and recovering water within an AMA. The key statutory provisions for storage facilities relate to hydrologic feasibility, A.R.S. § 45-811.01(C)(2); protection from unreasonable harm to land and other water users, A.R.S. § 45-811.01(C)(3); and avoidance of water quality impacts, A.R.S. § 45-811.01(C)(5). Although the Underground Water Storage, Savings and Replenishment Act contains requirements for water storage and for recovery, it also includes requirements linking storage and recovery to the management plan goals. The provision that affects non-recoverable storage is found in A.R.S. § 45-833.01(A), with a special requirement that non-recoverable water storage must be consistent with the AMA's Augmentation Program. The provisions that affect recovery are found in A.R.S. § 45-834.01; it includes a requirement for consistency with the management plan in the case of recovery outside the area of impact where the water is stored. A.R.S. § 45-834.01(A)(2)(b).

The Department has developed the Augmentation and Recharge Program for the Third Management Plan based on the statutory authorities and tools available to address the goals and objectives identified in the previous section. The program components will be presented in the order listed.

- Underground Water Storage, Savings, and Replenishment Program (section 8.7.1)
- Regulatory Incentives (section 8.7.2)
- Creation of a Groundwater Replenishment District (section 8.7.3)
- Purchase and Retirement of Grandfathered Rights (section 8.7.4)
- Technical Assistance, Coordination, and Facilitation of Efforts (section 8.7.5)
- Financial Assistance (section 8.7.6)
- Resolution of Legal and Institutional Barriers (section 8.7.7)

8.7.1 Underground Water Storage, Savings and Replenishment Program

One of the major goals of the Underground Water Storage, Savings and Replenishment (UWS) Program is to encourage the use of alternative water supplies by limiting the storage credits that can be accumulated over the long-term to water that cannot reasonably be used directly. A second goal of the program is to allow for efficient and cost-effective management of water supplies by eliminating the need for the construction of costly distribution systems by allowing water that is stored in one location to be recovered in another location.

In addition, the UWS Program increases the marketability of long-term storage credits by allowing all credits to be bought and sold, whereas previously only those credits accrued through in-lieu recharge were allowed to be sold or transferred to another water user. The program also allows credits to be extinguished by municipal providers to achieve compliance with their Second Management Plan per capita conservation requirements. Underground storage provides an additional benefit of restoring or preserving groundwater in areas where groundwater levels have declined. The UWS Program is, therefore, an important component of the Augmentation and Recharge Program.

As has already been reviewed, Arizona's UWS Program provides regulations under which water may be stored and rights to recover that water may be accrued. The statutes and policies of the UWS or "recharge" program, when read together, can be seen to establish a number of objectives. These include:

- To protect the general economy and welfare of the state by encouraging the use of renewable water supplies instead of groundwater, through a flexible and effective regulatory program for the underground storage, savings, and replenishment of water;
- To allow for the efficient and cost-effective management of water supplies by allowing the use of storage facilities for filtration and distribution of surface water instead of constructing surface water treatment plants and pipeline distribution systems;
- To further the conjunctive management of the water resources of this state to reduce the overdraft and achieve the management goals of the AMAs;
- To store water underground for seasonal peak demand use and for use during periods of shortage; and
- To augment the water supply for future growth and development.

Since its inception in 1986, the Recharge Program has become increasingly flexible over time with regard to storage and recovery locations and the number and types of programs available. With the increased flexibility has come an increased complexity and the potential for recharge projects to aggravate, as well as mitigate, local water problems. High water tables, low water tables, water quality, physical availability, and third party impacts are all problems that can be impacted positively or negatively by recharge facilities. Thus, the regulation of the program to maximize benefits and minimize harm is crucial to an effective program.

The following sections describe: (1) a brief overview of the UWS programs, (2) the definition of a storage facility, and (3) the storage and recovery location criteria that determine whether a recharge project is considered "consistent with the management plan and achievement of the management goal" of the AMA.

8.7.1.1 Overview of the Underground Water Storage, Savings and Replenishment Program

Persons who want to undertake recharge activities are required to obtain permits from the Department. There are three types of permits: (1) storage facility permits, which may be constructed underground storage facility (USF) permits, managed USF permits or groundwater savings facility (GSF) permits; (2) water storage permits; and (3) recovery well permits.

8.7.1.1.1 Storage Facility Permits

Storage facility permits allow the holder to construct, develop, and operate a storage facility. If storage is to occur at a facility that will use constructed basins or wells to add water to an aquifer, a constructed USF permit is required. If the storage will utilize the natural channel of a river or stream to add water to an aquifer, a managed USF permit is required. At a GSF, a groundwater user who would otherwise have pumped groundwater is provided an alternative supply of water by a water storer. The alternative supply is then used in lieu of the groundwater, thus preserving the groundwater.

8.7.1.1.2 Water Storage Permits

Water storage permits authorize the holder to store water at an affiliated storage facility. Rights to recover water under the UWS Program always accrue to the holder of the water storage permit, unless the water stored through the water storage permit is designated as non-recoverable.

8.7.1.1.3 Recovery Well Permits

Recovery well permits allow the holder to recover water stored pursuant to the UWS Program. The storer of the water may always recover the water stored within the area of impact of water storage, which is defined "as projected on the land surface, the area where the stored water has migrated or is stored."

A.R.S. § 45-802.01(2). Under a number of conditions, some of which are discussed in detail later in this chapter, recovery may also occur outside the area of impact. Theoretically, if these conditions are met, storage could occur anywhere within the AMA. Under no circumstance, however, can water be recovered in the AMA if it was stored outside the AMA.

8.7.1.1.4 Key Program Components

The UWS Program has a number of key components. Rights to recover water may be exercised annually or long-term. Almost any water can be recovered within the same year in which it was stored. If a number of conditions are met, stored water will be credited to a long-term storage account, which allows the account holder to recover the water at any point in the future. These conditions greatly assist the achievement of water management goals by preventing an entity from storing water and earning long-term storage credits if the water could be put to direct use. The statutes define what source water cannot be put to direct use and therefore, what may be eligible as long-term storage credits. A.R.S. § 45-802.01(21). In general, if an entity stores effluent it is determined that, until 2025, it cannot reasonably be put to direct use, and is therefore eligible to be stored as long-term storage credits.

No time limit exists on the right to recover long-term storage credits. Long-term storage credits may be assigned to another person if that person could meet the same provisions for earning credits as did the storer. In addition, once the water is recovered, it retains the same legal characteristics it had before storage.

The UWS Program is also the mechanism by which a groundwater replenishment district (GRD) replenishes water on behalf of its members. The GRD may store water and accrue long-term storage credits or obtain credits already accrued. At the GRD's request, the Department will transfer credits from the GRD's long-term storage account to its replenishment account, termed a "conservation district account" by statute, to offset the GRD replenishment obligations. A.R.S. § 45-859.01. Once the credits are transferred to the replenishment account, they may not be recovered, assigned, or moved back to the long-term storage account.

8.7.1.2 Underground Water Storage, Savings and Replenishment Program Issues

Arizona law generally prohibits artificial "bodies of water" constructed for landscape, scenic, or recreational purposes. However, one of the exceptions to this prohibition is if the body of water is "unsealed and an integral part of an underground storage facility." A.R.S. § 45-132(B)(6). One issue the Department considers carefully when permitting storage facilities is whether they are legitimate storage facilities that will meet the goals and intents of the program, including those facilities that "further the conjunctive management of the water resources of this state to reduce the overdraft and achieve the management goals of the AMAs," as stated in section 8.7.3.

With regard to USFs, A.R.S. § 45-815.01 specifically lists water systems that are categorically excluded as USFs. These include aqueducts, irrigation canals, and other man-made water conveyance systems. In addition, incidental recharge from any agricultural, municipal, mining, or industrial use is precluded from qualifying for a USF permit. Bodies of water, as defined in statute, do not qualify for USF permits unless they "have been designed, constructed or altered so that water storage is a principal purpose of the body of water." A.R.S. § 45-815.01(1). Thus, the law does allow for a body of water to be both a USF and a recreational lake. However, the Department guards against attempts by applicants to avoid the prohibition on recreational lakes by labeling a body of water a USF when its principal purpose is not underground storage. Thus, if the purpose of the facility is primarily recreational or aesthetic, it does not qualify as a USF. However, if the facility meets the goals, intents, and requirements of the USF Program while serving other uses as well, it may qualify for a USF permit.

Usually, the efficiency of a USF is related to its purpose. If a permit applicant's primary intent is to store water, achieving high efficiency at the facility is an important goal for the applicant. If the applicant's intent is to achieve multiple purposes, or if storage is not a primary purpose, efficiency is less important to the applicant.

Efficiency at USF's, however, is always a concern to the Department. As the AMA becomes more reliant on renewable supplies to meet a growing demand, as is required under the AWS Rules, efficiency of all surface water and groundwater use will be necessary. This program will serve to encourage efficient uses of water, and every effort will be made in the future to retain the integrity of the program and its intents and goals through maximizing the efficiency of recharge at permitted facilities. The Department examines projected efficiency of a USF as part of its review to determine whether a project is hydrologically feasible, which must be established before a USF permit will be issued. A.R.S. § 45-811.01(C)(2). The less efficient a proposed project is, the more the Department will examine it to determine if it is a legitimate USF. The Department will consider a number of factors when evaluating a facility for efficiency as a component of hydrologic feasibility, including the following:

- Whether the facility has the *potential* to store water, and the quantity of that potential storage
- Whether the facility is designed, constructed, or altered so that water storage is a principal purpose
- Whether other regulatory agencies impart conflicting standards to a facility (e.g., Arizona Department of Environmental Quality containment standards in a treatment wetland)
- Whether and how the facility will be maintained (e.g., wet-dry cycles, scraping, etc.) to ensure and/or enhance infiltration
- If a facility serves multiple purposes, whether the purposes other than recharge would not be legal or regulated without being associated with a recharge facility
- Whether potential water storers at the facility are subject to conservation requirements and lost and unaccounted for water limits under the management plan

The Department is also concerned about potential abuses in GSF permits. The statutes make clear that not every instance where groundwater use is replaced with a renewable water resource qualifies for a GSF permit. Only where the use of the renewable resource would not have occurred without the operation of the GSF and only where there is no other reasonably available alternative source should a GSF be permitted. A.R.S. § 45- 812.01(B).

While the groundwater savings program is an important tool in achieving the water management objectives by increasing the uses of effluent and preserving groundwater supplies, it must be remembered that 95 percent of the groundwater saved today will be pumped in the future through the use of long-term storage credits. The groundwater savings program is, in effect, a deferred groundwater pumping program and should not be confused with the conversion of an existing groundwater use to a renewable resource, which would provide a permanent savings of groundwater and a direct contribution to the achievement of safe-yield. For these reasons, the Department will not issue a GSF permit or storage credits unless a legitimate "groundwater savings" will occur or has occurred.

8.7.1.3 Storage and Recovery Siting Criteria

The benefits to water management through the Recharge Program depend on where the water is stored and recovered. Non-recoverable water storage is discussed in the next section.

For storage and recovery, unless stored water is recovered by the storer within the area of impact, the recovery is only allowed "if the director determines that recovery at the proposed location is consistent with the management plan and achievement of the management goal for the active management area." A.R.S. § 45-834.01(A). Recovery of stored water *within* the area of impact of the stored water is always considered consistent with the management plan.

Although the statute ties recovery outside the area of impact to the consistency requirements of the plan, the locations of storage and recovery of water are inherently linked. Both must be considered when determining whether the future recovery meets the consistency requirements and management goals of the AMA. Outside the area of impact, it cannot be determined whether recovery is consistent with water management objectives of the AMA unless the storage location is also considered. Water management benefits to the AMA would depend greatly on whether water recovered from an existing well was stored in a remote area of the AMA or in a large pumping center of the AMA. Therefore, the criteria to determine whether the recovery location is consistent with the management plan and goal for the AMA must also consider where water was stored.

The locations of storage and recovery are important factors in addressing local and regional supply problems, particularly in critical areas, and in attempting to balance the supplies in the AMAs during the third management period. For example, the future water supplies of the AMA may be diminished if water storage occurs in a remote location with no future demand for the stored water and recovery occurs outside the area of impact of storage. In addition, recovery outside the area of impact of water storage could aggravate problems if the area of recovery was experiencing rapidly dropping groundwater levels or if groundwater supplies were already fully committed under the AWS Program. On the other hand, if storage occurs in an area experiencing high water levels and recovery occurs away from the area of impact, the water storage will contribute to those high water levels. If dewatering is required as a *direct* result of water storage or savings, either the storage facility's operational plan should be adjusted to minimize impacts, which may include strategic recovery locations to mitigate impacts, or the storer may not be issued credits.

The Second Management Plan siting criteria provided no protection of groundwater supplies already committed under the AWS Program. However, the new Third Management Plan criteria protect groundwater supplies already committed for an assured water supply from an entity who wishes to recover water *outside* the area of impact.

The Third Management Plan criteria also link future use benefits to determinations under the AWS Program. If storage occurs in an area that has a committed and projected demand through a Designation of AWS or Certificate of AWS, then it is deemed to contribute to groundwater supplies that will be used in the future. If the storage does not meet these criteria, such as if it were located in a remote area with no committed or projected demands per a Designation of AWS or Certificate of AWS, it must be determined by the director to otherwise be beneficial to the AMA if recovery is to occur outside the area of impact of storage. If a storage facility is found not to meet the criteria, it will be indicated as such in the permit as a notice to potential water storers that future recovery may only be allowed inside the area of impact until such time that there is a demand for groundwater in the area of impact of the storage.

Recovery from within the area of impact is not required to meet management plan consistency requirements. Recovery may occur *outside* the area of impact of the storage only if the director determines that the recovery location is consistent with the management plan. A.R.S. § 45-834.01(A). Therefore, recovery must continue to be consistent with management plan criteria, even after the recovery well permit has been issued. Thus, previously permitted recovery wells are subject to the criteria of the Third Management Plan and future management plans.

8-101. Storage and Recovery Siting Criteria

During the third management period, for the purposes of A.R.S. § 45 834.01(A)(2)(b), recovery of stored water at a location is consistent with the management plan and achievement of the management goal for the active management area:

A. *If recovery will occur within the area of impact, regardless of whether the recovery well permit applicant was the storer of the water; or*

B. *If recovery will occur outside of the area of impact, all of the following three criteria are met:*

1. *The water storage that resulted in the right to recover water:*

    a. *Is contributing to groundwater supplies that are accessible to current groundwater users or that have been committed to establish a Designation, Certificate, or Analysis of Assured Water Supply pursuant to A.R.S. § 45-576 or rules adopted thereunder so long as the areas in which water is stored are not experiencing problems associated with shallow depth to water; or*

    b. *Is a component of a remedial action project under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, and the director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or*

    c. *Is otherwise determined by the director to have contributed to the objectives of this chapter or the achievement of the management goal for the active management area.*

2. *Either:*

    a. *At the time of the application, the maximum projected depth to water at the location of the recovery well after 100 years does not exceed the general 100-year depth-to-static water level for the AMA specified by A.A.C. R12-15-703 after considering: (1) the maximum proposed withdrawals from the recovery well; (2) withdrawals for current, committed, and projected demands associated with determinations made under A.R.S. § 45-576 that are reliant on the water which the recovery well will withdraw; and (3) withdrawals for other current or projected demands that are reliant on the water which the recovery well will withdraw; or*

    b. *The recovery will be undertaken within the applicant's service area and the applicant is a municipal provider designated as having an assured water supply.*

3. *The recovery well is:*

    a. *Located in an area experiencing an average annual rate of decline that is less than 4.0 feet per year; or*

    b. *A component of a remedial action project under CERCLA or Title 49, Arizona Revised Statutes, and the director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or*

    c. *Likely to contribute to the water management objectives of the geographic area in which the well is located, as determined by the director.*

8.7.1.4 Criteria for Storage of Non-Recoverable Water

Pursuant to A.R.S. § 45-833.01(A), "the director may designate a water storage permit as storing non-recoverable water. If the water storage occurs within an active management area, the water storage permit may be designated in this manner only if the storage is consistent with the active management area's

augmentation program." The director may make this designation only upon application by a proposed water storer.

Only in few instances has this designation been applicable to date. In the second management period, non-recoverable storage occurred in association with certain augmentation grants that included storage of water to test the hydrologic feasibility of a recharge site. The Department has not allowed augmentation grant money to be used to purchase water supplies for storage and recovery for a grantee. Therefore, water stored in association with certain grants has been designated as non-recoverable. Under the Third Management Plan, non-recoverable water storage may also occur as a result of an enforcement action associated with non-compliance of conservation requirements.

Water that is stored under a permit with this designation may not be recovered on an annual basis, may not be credited to a long-term storage account, and may not be used for replenishment purposes associated with a GRD. The same considerations discussed in the preceding section that shaped the criteria for recovery location have shaped the criteria for siting non-recoverable storage.

8-201. Criteria for Storage of Non-Recoverable Water

During the third management period, water storage that is designated as non-recoverable is consistent with the AMA's Augmentation Program if one of the following criterion is met:

The water storage:

1. *Is contributing to groundwater supplies that are accessible to current groundwater users or that have been committed to establish a Designation, Certificate, or Analysis of Assured Water Supply pursuant to A.R.S. § 45-576 or rules adopted thereunder so long as the areas in which water is stored are not experiencing problems associated with shallow depth to water; or*

2. *Is a component of a remedial action project under CERCLA or Title 49, Arizona Revised Statutes, and the director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or*

3. *Is otherwise determined by the director to contribute to the objectives of this chapter or the achievement of the management goal for the active management area.*

8.7.2 Regulatory Incentives

Provisions established in the Agricultural, Municipal, and Industrial Conservation Programs of this management plan provide incentives for water users to utilize renewable resources. The inclusion of renewable supply incentives is somewhat controversial due to the perception that encouraging the use of a renewable supply may result in an inefficient use of the supply. The program to increase the use of renewable water supplies should not be perceived as an alternative to conservation.

The Code (particularly through the assured water supply provisions) and the management plans require a long-term perspective on supply and demand. In the long term, efficient use of all water supplies will be necessary. The distinctions that are now being made among sources of water, including incentives that allow increased use of certain renewable sources, may seem ill-advised in hindsight. It would be inappropriate not to build a conservation ethic into the structure of the Prescott AMA communities, even as they move towards the use of renewable supplies.

Some uses of water can be identified as "structural" and others as "discretionary." Structural uses are part of the base water use requirement; for example, once a swimming pool is built, it is likely to be filled with water. However, the decision to overseed a lawn or a golf course in a particular year is discretionary, or non-structural. As incentives were designed for inclusion in this plan, the Department emphasized that increased utilization of renewable supplies should be for non-structural purposes, so that the use can be scaled back if available renewable supplies become scarce. Although it is unlikely a renewable supply shortage will occur during the third management period, promoting efficient use of all supplies now in anticipation of future shortages is responsible water management.

Achievement of the water management goals over the long term is only possible in the context of serious, long-term conservation efforts and increased utilization of renewable supplies. The debate is not between conservation and augmentation, but rather, whether the concept of "efficient use" can be integrated into the regulatory system and the community ethic. Matching the resources to the most appropriate demand will require more sophisticated management, including conjunctive management of groundwater and surface water, than has been the norm in Arizona in the past. It is difficult to design incentives that are administratively workable without causing equity problems and weakening the conservation message that is crucial in protecting our resources for the future.

Table 8-2 lists the Third Management Plan incentives to use alternative supplies. Some of these incentives were established in the Second Management Plan. Because many of these incentives encourage use of alternative supplies at the expense of conservation, the incentives may need to be scaled back in the future to achieve safe-yield.

Although the need to include specialized incentives to address subregional conditions has been identified, the only regulatory tool to date for addressing localized areas of decline is the limitation on recovery of recharged water if it is recovered outside the area of hydrologic impact. The compliance approach described in Table 8-2 may result in encouraging recharge in specific locations to address local hydrologic concerns.

8.7.3 Creation of a Groundwater Replenishment District

The Department will work with the Prescott AMA water users to evaluate the feasibility of creating an augmentation and groundwater replenishment district to coordinate the delivery of alternative water supplies to those water users who would otherwise be unable to put them to beneficial use. Such an entity could be used as a basis for managing water contracts between owners of alternative supplies and those wishing to use alternative supplies. It could also be used to cover those areas of the Prescott AMA that are outside of municipal jurisdiction or private water company service areas, particularly through the financing of potable delivery systems and wastewater treatment systems or through groundwater replenishment. It could serve as a means to improve communication and management of water supplies for Prescott AMA uses.

The Central Arizona Groundwater Replenishment District (CAGRD), created in 1993, could serve as a model for developing a local groundwater replenishment district in the Prescott AMA. The CAGRD, administered by the Central Arizona Water Conservation District, uses excess CAP water and other alternative water supplies to replenish aquifers for groundwater use by CAGRD members in excess of their groundwater allocations under the AWS Rules. Membership in the CAGRD is voluntary though it serves as a basis for meeting the renewable water supply requirement of the AWS Rules. Because it only serves AMAs with access to CAP water, however, membership is not available to water users in the Prescott AMA.

TABLE 8-2
RENEWABLE WATER SUPPLY UTILIZATION INCENTIVES
PRESCOTT ACTIVE MANAGEMENT AREA

Municipal
Delivery of effluent by a municipal water provider does not count against the gallons per capita per day (GPCD) requirement, unless effluent is recharged in one location and recovered outside the area of impact. This is an incentive for municipal providers to invest in reclaimed water systems (Chapter 5, section 5.8). The Alternative Conservation Program removes the non-residential portion of the GPCD requirement for providers who limit their groundwater use to the highest annual use between 1980-1989, utilize renewable supplies for their remaining demand, and implement specific conservation measures for non-residential customers. This program also includes an incentive to extinguish existing grandfathered rights to groundwater (Chapter 5, section 5.7.1.3.1). The Non Per Capita Program removes the GPCD rate as a regulatory tool entirely in exchange for implementation of specified conservation programs. A "best management practices" approach is designed to achieve the same level of efficiency as the GPCD, but the point of compliance is implementation of the programs, not the level of water use. To qualify, water providers must phase out groundwater use, or have a Designation of AWS (Chapter 5, section 5.7.1.2.3).
Industrial
Turf Effluent use is discounted when calculating compliance with the annual allotment for each facility. For the Third Management Plan, the incentive has been increased to a 40 percent discount (the Second Management Plan discount was a maximum of 20 percent) (Chapter 6, section 6.3.5.3). If 100 percent of the water used at a facility in a year is from a non-groundwater source, no compliance is required with the annual allotment for that year.
Cooling Towers Cooling towers that beneficially reuse 100 percent of their blowdown water are exempt from meeting the blowdown concentration requirements (Chapter 6, section *6-502.B.1*). Cooling towers that convert to at least 50 percent effluent are exempt from the blowdown concentration requirements for one full year. If it is shown that they cannot meet the requirements, amended blowdown concentration levels may be applied (new incentive in the Third Management Plan) (Chapter 6, section *6-502.B.3*).
Agricultural
Pursuant to A.R.S. § 45-467, effluent use cannot contribute to a farm exceeding its allotment in any year. In determining whether a farm exceeds its maximum annual groundwater allotment for a year, total water use, including groundwater, effluent, and surface water, is counted and any effluent used that year is subtracted from the amount of groundwater that otherwise would have exceeded the farm's allotment.

The CAGRD provides for two types of membership: 1) by municipal providers ("member service areas") seeking to support a Designation of AWS, and 2) by individual subdivisions, for developers seeking a Certificate of AWS ("member lands"). Members are assessed an annual replenishment fee on a per acre-foot basis. For member service areas, the municipal provider pays these fees. For member lands, the parcel owner pays the fee through a property tax assessment which reflects excess groundwater use for that parcel.

The CAGRD has three years in which to fulfill its groundwater replenishment obligation for a given year. The CAGRD, not its members, determines how the replenishment obligation will be met.

The responsibilities of a local groundwater replenishment district in the Prescott AMA could include:

- Developing and operating infrastructure for distributing imported groundwater or alternative water sources supplies within the AMA
- Managing water exchange or replenishment contracts
- Managing resources to minimize drought impacts
- Assisting applicants seeking assured water supply certification or designation to meet regulatory requirements
- Participation in regional negotiations regarding water supply planning
- Contracting and operating underground storage and recovery projects
- Monitoring and managing water levels
- Regional water supply planning and management

In the third management period, the Department will encourage dialogue about creating a GRD, and, if it is feasible, will facilitate creation of a GRD.

8.7.4 Purchase And Retirement Of Grandfathered Rights

The Code specifies that the Third Management Plan may include a program for the purchase and retirement of grandfathered rights by the Department not to begin earlier than January 1, 2006. A.R.S. § 45-566(A)(9). The possibility of the Department purchasing grandfathered rights and retiring them is being considered for inclusion in the Third Management Plan beginning in 2006. If the plan were to be modified to include such a program, it could provide the Prescott AMA with another method for reducing groundwater overdraft and helping to achieve the management goal. The purpose of this section is to analyze those issues that need to be considered in determining the feasibility of developing and implementing such a program in the Prescott AMA.

The focus of this analysis is on the purchase and retirement of lands associated with irrigation grandfathered rights (IGFRs). Although a purchase and retirement program could also legally include Type 1 and Type 2 non-irrigation grandfathered rights, these rights may be more expensive to retire. Purchase and retirement could possibly be offset by increases in General Industrial Use permits, thereby defeating the objective of reducing groundwater demand. At a minimum, the program should be limited to those IGFRs that use groundwater exclusively and do not lie in the path of urban development. In addition, IGFRs that would be targeted for purchase and retirement should be required to meet one or more of the following secondary criteria: (1) high water duties, (2) high percentage of annual groundwater use (if not exclusively groundwater), (3) history of high consumptive use crops, (4) history of high land utilization rates, and (5) in areas historically exhibiting high groundwater decline rates.

8.7.4.1 Potential Groundwater Savings under Purchase and Retirement

To analyze the potential groundwater savings that could be realized from an IGFR purchase and retirement program in the Prescott AMA, a representative estimate was made of 1996-97 agricultural land prices for

those farming areas that best meet the proposed minimum program criteria listed above. A representative estimate was also made of annual groundwater use per acre for those IGFRs that grow high consumptive use crops and have high land utilization rates. Using this information, the AMA's average annual groundwater pumping and in-lieu water use for the 1990-96 period, and a purchase and retirement fee of $2.00 per acre-foot, the potential groundwater savings that could be realized in the first year from an IGFR purchase and retirement program were determined. These savings and associated program impacts are shown in Table 8-3.

TABLE 8-3
POTENTIAL GROUNDWATER SAVINGS AND ASSOCIATED IMPACTS
IGFR PURCHASE AND RETIREMENT PROGRAM - FIRST YEAR
PRESCOTT ACTIVE MANAGEMENT AREA

Total Purchase and Retirement Fees Collected [a]	Farmland Purchased and Retired (acres) [b]	Total Groundwater Savings (acre-feet) [c]	Cost of Groundwater Savings (per acre-foot) [d]
$32,200	3.58	12.53	$2,570

[a] Assumes 16,100 acre-feet of groundwater pumping and use of alternative water supplies in the AMA.
[b] Assumes use of all fees collected and a $9,000 per acre purchase cost.
[c] Assumes 3.5 acre-feet per acre of historic groundwater use.
[d] Reflects land purchase cost only.

If an IGFR purchase and retirement program were to be included in the Third Management Plan, it could not, by statute, be implemented before 2006. Making no changes in the assumptions used in Table 8-3 to determine first year program impacts, the potential groundwater savings for the five-year period from 2006 to the end of the third management period in 2010 would only be 62.65 acre-feet.

It is unlikely, however, that a purchase and retirement program would be ended after only five years. A more realistic assumption is that the program would be extended through the end of the fifth management period in 2025. Assuming no change in agricultural land prices, a 20-year purchase and retirement program would result in average annual groundwater savings of 250.6 acre-feet.

Even without considering the costs to manage and maintain the retired farmland, it is clear from the above analysis that saving water in the Prescott AMA through purchase and retirement would be expensive. Other augmentation or demand reduction measures could be more cost effective to implement.

It should also be noted that the potential water savings assume that the farmland that would be retired would not be offset by inactive farmland being brought back into production. The potential for such a "rebound effect" could occur in the Prescott AMA if cattle prices rebound and fallow pasturage is returned to use.

8.7.4.2 Land Management and Maintenance Issues

Before a purchase and retirement program could be developed and implemented in the Prescott AMA, issues involving land management and maintenance would need to be addressed. These issues include, but are not limited to, the following:

- Funding for staff and other resources needed to manage the retired farmland
- Liability claims
- Impacts of removing the land from the county and local property tax base

- Control of noxious weeds and dust on the land

One management option would be to transfer retired farmland to the State Land Department. Unless the land is suitable for grazing, however, this option may not be feasible. The State Land Department is required by the state constitution to generate revenue from the use of state lands and uses other than grazing would almost certainly require a water supply.

8.7.4.3 Future Directions for Purchase and Retirement Program

For the Prescott AMA to meet its management goal, as quantified in this management plan, an IGFR purchase and retirement program could have limited success in reducing the excess overdraft, especially if the program included the purchase of the land associated with the IGFR. However, the program does not necessarily have to include the purchase of the land. Instead, another option may be to purchase and retire the grandfathered rights only, but not the land. If the Department decides to modify the Third Management Plan to include such a program in the AMA, the rebound effect and land management and maintenance issues need to be fully addressed before the program is implemented.

The Prescott AMA is unique in the fact that agricultural land is relatively expensive compared with other AMAs in the state. Therefore, if the program includes the purchase of land associated with an IGFR, the cost of a purchase and retirement program in the Prescott AMA may be prohibitive. Given the cost, limited potential groundwater savings and land management problems associated with a purchase and retirement program involving the purchase of land, such a program is unlikely to prove useful for the Prescott AMA.

8.7.5 Technical Assistance, Coordination, and Facilitation

The Department will continue to support augmentation project construction, planning, and research activities during the third management period. Technical assistance will be provided to entities in assessing the need for augmentation projects (especially in critical areas), determining project feasibility, and reviewing project impacts. Department staff will participate on oversight committees, provide data, and review planning and feasibility study reports. To facilitate research projects, the Department will assist entities by conducting research activities, assisting in study design, providing data, reviewing results, and disseminating information. The development and use of the hydrologic model for the Prescott AMA will also assist in water planning efforts.

Many augmentation activities during the third management period will require the participation of water users, government agencies, and a variety of interest groups. Cooperative efforts among the participants will allow the development of more effective projects and studies. The Department will work with organizations to coordinate and facilitate augmentation activities. Examples of these activities include: (1) developing a critical management area strategy, (2) exploring the potential to facilitate and coordinate augmentation and/or recharge projects in the Prescott AMA through a groundwater replenishment district or otherwise, (3) participating in discussions with various federal, state, and local entities concerning water resource, water quality, and wildlife management issues which impact water management efforts in the Prescott AMA.

8.7.5.1 Critical Area Strategy Planning

As described in Chapter 2 and summarized in the physical assessment section of this chapter, certain areas within the AMA are experiencing water management problems that are more serious than in other portions of the AMA. These areas could continue to experience severe water management problems even if safe yield is achieved on an AMA-wide basis unless a more localized approach to water management is implemented. Therefore, the Prescott AMA will place more emphasis on these areas through the third

management period to develop a strategy to address the problems within the current legal authority. Planning efforts may include: (1) developing local/state partnerships, (2) identifying stakeholders, (3) identifying problems, (4) identifying groundwater pumping issues, (5) conducting hydrogeologic investigations as necessary, (6) examining new legislation and/or local ordinances to remove barriers to problem mitigation, (7) developing programs, and (8) creating incentives that contribute to a solution.

8.7.6 Financial Assistance

The Department's Augmentation Assistance Program is described fully in Chapter 9. This program provides funding for augmentation, reuse, and recharge projects to enhance the region's water supply through grants, contracts, and intergovernmental agreements. This fund will also be available to fund projects for monitoring or assessing water availability within the AMA.

8.7.7 Resolution of Legal and Institutional Barriers

The Department will continue to work with interested parties in the AMAs and around the state to draft rules and propose legislation that will resolve legal and institutional barriers to augmentation activities. Among the barriers are difficulties with the recharge permitting process and conflicting objectives of various regulatory programs. Some problems the Department can address with its existing resources, tools, and authorities, such as revising the well spacing and impact rules. The Department can also indirectly influence progress in some areas through support of legislation. For some issues, new or revised statutory authorities may be necessary. Augmentation activities in the Prescott AMA, particularly in regard to the importation of groundwater from the Big Chino Subbasin, could also be affected to various degrees by federal and state water quality and wildlife protection laws and regulations. Water quality laws and regulations are described in Chapter 7.

8.7.7.1 Endangered Species Act

Endangered and threatened species will need to be considered prior to development of augmentation projects to insure that the project does not "take" an endangered species of fish or wildlife and, if the project is an "agency action," to insure that endangered or threatened species are not jeopardized and critical habitat is not adversely modified. The Endangered Species Act (ESA) protects species primarily through two mechanisms: the consultation requirement and the "take" prohibition.

First, each federal agency has the duty to consult with the United States Fish and Wildlife Service (USFWS) over any federal agency action that "may affect" endangered species or habitat, and the USFWS has the authority to require reasonable and prudent alternatives and remedial measures as a condition to continued federal action. The ESA requires that federal agencies consult with the USFWS to insure that "agency actions" are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. Agency actions include any action authorized, funded, or carried out by a federal agency.

Second, the ESA prohibits any person from taking a listed endangered species of fish or wildlife without an incidental take permit. The term "take" means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

The ESA could impact the ability of Prescott AMA municipal providers to retrieve groundwater from the Big Chino Subbasin as allowed by the Groundwater Transportation Act. If groundwater withdrawals in the Little Chino and Big Chino Subbasins are determined to jeopardize or take listed species along the headwaters of the Verde River and its reaches through the Verde Valley, then such transfers could be federally restricted or prohibited. Some preliminary studies of the Big Chino Subbasin have been done to determine the impact of groundwater pumping on the Verde River and endangered species such as the

Spikedace Minnow and the Southwestern Willow Flycatcher. Additional studies are needed to determine how much groundwater can be withdrawn from the Big Chino Subbasin, and the Department will have to coordinate with other agencies, local communities, and water users to resolve any potential Endangered Species Act concerns.

8.8 ADDITIONAL WATER MANAGEMENT TOOLS

Beyond the third management plan programs, the following sections describe other management tools that assist water users in achieving water management objectives.

8.8.1 Assured Water Supply Rules

The Assured and Adequate Water Supply Rules are a primary tool in achieving the AMA's management goals and ensuring sufficient water supplies for new development. This program provides the largest impetus for water providers to develop Augmentation and Recharge Programs through the need to have a safe, secure water supply to meet demands for 100 years. To be consistent with the Assured and Adequate Water Supply Rules, water providers or developers must acquire renewable supplies for direct use or underground storage to meet future demand.

8.8.2 Water Exchanges

Water exchanges are water-for-water trades between two or more parties that improve the management of limited water supplies. Water exchanges can reduce the cost of water deliveries and allow the quality of water to be matched with the requirements of the user. Water exchanges are governed by A.R.S. §§ 45-1001, *et seq.*

8.8.3 Well Spacing Rules

The Code states that the director shall adopt rules governing well locations, A.R.S. § 45-598(A), and may adopt rules governing pumping patterns, A.R.S. § 45-601, to minimize damage to adjacent land and water users. The Department is currently evaluating existing draft well spacing and well impact rules pursuant to the criteria specified by A.A.C. R12-15-830; however, the Department also is considering new rules. New rules in this area could better address the statutory requirements of protection, including criteria with which potential subsidence-related impacts and damage may be quantitatively evaluated. This could also assist in the goals of this Augmentation Program by allowing greater scrutiny of localized aquifer conditions.

8.8.4 Water Protection Fund Grants

Legislation establishing the AWPF Commission was passed in 1994. The purpose of the AWPF is to provide grant monies to water users for implementing projects to protect or restore the state's rivers and streams, including the purchase of effluent for riparian enhancement. The Legislature appropriated $4 million for the AWPF from the state general fund in 1994, $6 million in 1995, $1.6 million in 1996, $5 million in 1997, and $1.6 million in 1998. It is projected that $4.5 million will be appropriated in 1999.

AWPF grants could impact future augmentation activities in the Prescott AMA by providing funds to develop riparian enhancement projects which would use effluent. While the amount of incidental recharge occurring due to these activities would increase, new or enhanced riparian areas also create an additional demand for water supplies. Overall, there are limited riparian sites within the Prescott AMA suitable for AWPF projects and few entities have the financial resources necessary to undertake them.

8.9 CONCLUSION

The focus of this chapter has been on defining the Department's role in augmenting the water supplies of the Prescott AMA for the third management period. The augmentation issues summarized in this chapter show that there is continuing need for active participation by the Department in augmentation activities to facilitate achievement of the AMA's water management goal and objectives. An augmentation and recharge program has been developed that will use regulatory incentives, technical and planning assistance, coordination and facilitation of cooperative efforts, resolution of legal and institutional barriers, financial assistance, storage and recovery location criteria, and possibly the purchase and retirement of irrigation grandfathered rights to enhance the Department's ability to reduce reliance on Prescott AMA groundwater and encourage the use of alternative water supplies in the AMA. Some new statutory authorities may be needed by the Department in the future to ensure that the AMA's management goal and objectives can be achieved.

Alternative supplies are available for beneficial use within the Prescott AMA. Sources of effluent, surface water, imported groundwater, and extinguished grandfathered rights for assured water supply comprise a sufficient volume of supply to meet future growth based on current demand trends. However, the access to alternative water supplies is not equitably distributed throughout the Prescott AMA. The management challenge is to determine how alternative water supplies can be put to maximum beneficial use by water users within the Prescott AMA. This will also entail the exploration of how to connect large concentrations of domestic wells, which face a greater threat of well failures, with existing or new potable water delivery systems in an affordable manner.

8.10 FUTURE DIRECTIONS

Many issues must be addressed in order to achieve safe-yield and the other objectives discussed in this chapter. There is a growing recognition that the regulatory and non-regulatory tools available may not be sufficient to meet the AMA water management objectives. As has been discussed, numerous factors affect water use patterns, many of which are not affected by the Department's programs. Although some Code provisions are directly linked to achievement of the management goal, water management tools could be improved in many ways. New statutory authorities may be needed by the Department in the future to ensure achievement of the Prescott AMA's water management goals and objectives, including sub-regional objectives.

Critical area management strategies need to be formulated during the third management period to attempt to move beyond the AMA-wide goal and address water management problems in specific geographic areas of the AMA. The critical area strategy program will focus on problems associated with groundwater pumping, such as large cones of depression, reduction in aquifer storage capacity, and the reduced physical availability of supplies. These efforts will require partnerships with entities from the areas in question who are willing to make necessary changes and support more stringent requirements to improve groundwater conditions.

The concept of a water improvement district or an augmentation and groundwater replenishment district is a possible mechanism for coordinating the delivery of alternative water supplies to those water users who would otherwise be unable to put them to beneficial use. The Department will continue to evaluate the feasibility of creating such an entity and will work with the local community to provide an ongoing dialogue on the issue.

It may be necessary to reexamine the AWS Rules provision that deems groundwater up to 1,000 feet below the land surface to be physically available. Allowing groundwater levels to fall this low may result in subsidence and earth fissures, water quality problems, and problems with well productivity.

Further examination of the purchase and retirement of IGFRs will be conducted. Issues such as whether the current withdrawal fee would be sufficient to successfully carry out this program and whether the Department will consider the purchase and retirement of the lands associated with the rights will be evaluated.

The Third Management Plan storage and recovery criteria relating to the decline rate remained consistent with the Second Management Plan. However, further evaluation will be conducted in the third management period to determine whether more stringent criteria is warranted, especially in relation to developing a critical management strategy.

APPENDIX 8
DECLINE RATE METHODOLOGY

In evaluating an application for a proposed recovery well permit, the Department considers many factors in determining consistency with the average water level decline rate siting criteria. The time frame for which the average is calculated may vary based on data availability and the hydrologic characteristics of the area. Major trends in precipitation, water supply utilization over time, hydrogeologic data, and the modeling of projected impacts may be factors in evaluating this rate. Other considerations may also be appropriate depending on the location of the proposed recovery well.

Typically, the Department examines the historic static water level data for the period of record for wells located in the section in which the proposed recovery well is located and in the adjacent eight sections. The specific area examined depends on the availability and quality of water level data and the hydrogeology of the area. Bedrock outcrops, large pumping centers, and other features may affect the determination of pertinent data. Generally, wells that are screened in the aquifer of concern and regularly monitored using consistent methods for static water level data are good reference points (such as the Department's statewide monitoring or index wells). The Department examines the well hydrographs (graphs of static water levels over time), and evaluates the slope of the curve for the period of interest. The slope indicates whether the static water level in the monitoring well has risen or fallen over time. A horizontal line on the hydrograph indicates that water levels remained stable over time. The Department identifies what activities may have caused the groundwater changes over time to see whether the activity still exists or has been reduced, eliminated, or increased over time.

This approach provides more flexibility and protection of the groundwater resource than would be provided by a simplistic evaluation of decline rates calculated for all water level data within a set radius and during the entire period of record. For example, if a recovery well is proposed for an area which historically had a rapid decline in groundwater levels due to activities that no longer exist (e.g., retirement of agriculture after heavy agricultural use in the 1940s and 1950s), and if the proposed area is not at high risk for subsidence, the proposed recovery well might be deemed consistent with the average decline rate criteria by looking at the period of time after the historic change in use. Similarly, if water levels in the vicinity of the proposed recovery well were stable for decades, but recently a new use caused rapid rates of decline, the proposed recovery well may be deemed inconsistent with the criteria.

The Department's groundwater models may be used to project future water levels and decline rates on a regional basis. Modeling may assist the permittee in evaluating recovery options. Where there are sufficient data, a model may give an indication of how long recovery within a region may remain permitted based on the current average decline rate criteria.

The most current procedures for establishing the average groundwater level decline rate in the vicinity of a proposed recovery well will be published in the Department's Recovery Well Application Packet.